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Water Standards and Studies Report #85-1

Manitoba
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BIBLIOGRAPHY
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WATER STANDARDS AND STUDIES, REPORT #85-1

ABSTRACT

Brown, D. J. 1985. Bibliography of Water Standards and Studies Section Publications, 1984. Environmental Management Division. Water Standards and Studies Report #85-1. 11 pp.

The Water Standards and Studies Section, Environmental Management Services Branch, Manitoba Environment and Workplace Safety and Health produced seven manuscript reports, three water quality assessment reports, two water quality data reports and four miscellaneous information brochures during 1984.

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INTRODUCTION

The reports listed in this document were prepared by staff of the Water Standards and Studies Section, Environmental Management Services Branch of Manitoba Environment and Workplace Safety and Health. Each report was distributed by the Department as it became available. Enquiries for copies should be directed to the following:

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MANUSCRIPT REPORTS

REPORT 84-1 Brown, D. J. 1984. Bibliography of Water Standards and Studies Section Publications, 1983. Environmental Management Division. Water Standards and Studies. 20 pp.

SUMMARY

The Water Standards and Studies Section, Environmental Management Services Branch, Manitoba Department of Environment and Workplace Safety and Health produced twenty-four reports. In 1983 one additional report was produced jointly with the Terrestrial Standards and Studies Section.

REPORT 84-2 Beck, A. E. 1984. An Investigation of Snow Lake and Herblet Lake in Relation to an Inoperational Gold Mine Complex. Environmental Management Division, Water Standards and Studies. 67 pp.

SUMMARY

The proximity of an arsenical gold ore concentrate stockpile and a tailings disposal site to the Town of Snow Lake has caused concerns regarding the potability of the Town's water supply (Snow Lake) and the water quality of nearby Herblet Lake. Water Standards and Studies Section addressed these concerns by carrying out an investigation in July, 1981. Metal levels in fish and sediments and a number of physicochemical parameters in the water columns of Snow and Herblet Lakes were examined. Drainage patterns and metal concentrations at both the stockpile and tailings site were also considered.

The pattern of drainage from the ore concentrate stockpile was towards Snow Lake via Canada Creek. Stockpile leachate had resulted in arsenic levels elevated beyond background in proximal areas of both the water column and sediments of Snow Lake. However, waters remained potable as mean arsenic concentrations (0.004 mg/L) were well below both the Manitoba surface water quality objective (0.01 mg/L) and the federally recommended maximum acceptable concentration (0.05 mg/L). Other parameters examined and fish were not detectably affected.

The pattern of drainage from the tailings disposal site was through a small bog towards Herblet Lake. Tailings leachate had resulted in arsenic levels elevated beyond background in the water column, sediments and fish of the southwestern portion of Herblet Lake. Copper concentrations in sediments were also found to be above background. Sewage discharges through the tailings area have moderated the potential for acid production and a minor alkalization has occurred in Herblet Lake. Other parameters examined showed no detectable impacts upon the water column, sediments and fish of Herblet Lake.

REPORT 83-3 Beck, A. E. 1984. 1981-1982 Mercury Levels in Fish of the Assiniboine, Red, Souris and Winnipeg Rivers. Environmental Management Division. Water Standards and Studies Section. 82 pp.

SUMMARY

The Biomonitoring Program commenced in 1978. As in previous years, the mercury facet of the 1981 and 1982 program warrants special attention.

Muscle tissue samples were collected from the dominant large-sized fish species occurring at several locations on the Assiniboine, Red, Souris and Winnipeg Rivers. The samples were analyzed for mercury content and the results were statistically compared to those of previous years. Where data permitted, mercury concentrations versus fish weight regressions were developed and used to estimate weights at which various species might be expected to contain excessive muscle tissue mercury concentrations.

Walleye from the Assiniboine River biomonitoring sites generally possessed mean mercury concentrations in excess of the 0.50 µg/g level. Additionally, it was estimated that walleye larger than the 575 g - 880 g range might be expected to exceed the 0.50 µg/g level and, if larger than approximately 2000 g, might be expected to possess muscle tissue mercury concentrations greater than the 1.0 µg/g level. Walleye from Emerson and St. Norbert exhibited patterns similar to Assiniboine River fish. Although mean mercury concentrations in walleye collected near Selkirk were lower than the 0.50 µg/g level, it was estimated that fish larger than approximately 1750 g might be expected to exceed the 0.50 µg/g level.

In general, Winnipeg River walleye also possessed excessive mean mercury concentrations which were highest at Eaglenest Lake and lowest at Lac du Bonnet. Most walleye from the Souris River were also found to contain excessive mercury concentrations.

Northern pike from Portage la Prairie and the three Winnipeg River biomonitoring sites generally possessed mean mercury concentrations in excess of the 0.50 µg/g level. Particulary contaminated were Eaglenest Lake fish which were estimated to possess mercury concentrations in excess of the 0.5 µg/g level at weights greater than approximately 2750 g.

Sauger from Portage la Prairie, Emerson and St. Norbert frequently possessed mercury concentrations above 0.50 µg/g. Additionally, it was estimated that sauger from the Red River at Selkirk which were larger than approximately 330 g might also be expected to exceed the 0.50 µg/g level. Although Lac du Bonnet sauger still contain mean concentrations in excess of 0.50 µg/g, the data suggest that mercury concentrations have been progressively declining since inception of the Biomonitoring Program.

Large channel catfish (i.e. >4000 g) and goldeye (i.e. >480 g) from Emerson and St. Norbert might be expected to possess excessive mercury concentrations. Mooneye, goldeye, freshwater drum, lake whitefish and most suckers generally possessed mean mercury concentrations well below the 0.50 µg/g level.

The mean 1981 and 1982 mercury concentrations showed few statistically significant changes from those of previous years.

REPORT 84-4 Beck, A. E., and D. Wilson. 1984. Bibliography of Mercury in Manitoba Fish. Environmental Management Division, Water Standards and Studies. 9 pp.

SUMMARY

The bibliography consists of references which list numerical values or classifications pertaining to mercury concentrations in fish taken from Manitoba waters. A total of 43 publications and 3 data banks are listed alphabetically by author or

government department. Citations containing data of a detail sufficient for the development of regressions are further identified.

REPORT 84-5 Williamson, D. A. 1984. Preliminary Investigation into the Presence of Agricultural Pesticides in the La Salle and Assiniboine Rivers, Manitoba, Canada. Environmental Management Division, Water Standards and Studies. 37 pp.

SUMMARY

The La Salle River, Manitoba, Canada, is being considered as a source for municipal domestic water supply. One such project, entitled the "Elie Aquifer Enhancement Project" proposed to divert surface water from the La Salle River into a near-surface groundwater aquifer. Groundwater from this aquifer provides the Town of Elie with domestic water supply. However in recent years, this aquifer has become increasingly saline due to salt-water intrusion from lower aquifers. It was expected that enhancement of this near-surface aquifer with La Salle River water would alleviate the taste concerns resulting from this natural increase in dissolved mineral content. Because of the extensive agricultural land-use activities within the La Salle River watershed, delineation of pesticide concentrations within the La Salle River was necessary prior to determining the suitability of such water for this groundwater recharge project.

Water samples were collected from the La Salle and Assiniboine Rivers during 1983/1984 and were analyzed for twenty-seven agricultural pesticides. The herbicides triallate, trifluralin, dicamba, MCPA, diclofop-methyl and 2,4-D plus the insecticide azinphos-methyl were detected in samples collected from the La Salle River. The herbicides triallate, trifluralin, dicamba and MCPA were detected in samples collected from the Assiniboine River. The mechanism of transport was not part of this investigation, but appeared related to snow-melt and rainfall runoff events.

Ambient concentrations of trifluralin, azinphos-methyl, dicamba, MCPA and 2,4-D did not exceed the available criteria derived for the protection of human health following long-term consumption. Further investigations, however, are required to determine the significance of the

reported carcinogenic response exhibited by trifluralin towards one laboratory animal species tested.

The scientific information is too limited to determine the human health significance of the measured triallate concentrations in the La Salle and Assiniboine Rivers and the diclofop-methyl concentrations in the La Salle River.

It appeared that the measured concentrations of trifluralin, dicamba, MCPA, diclofop-methyl and 2,4-D in the La Salle River and trifluralin, dicamba and MCPA in the Assiniboine River should not pose a chronic threat to aquatic life. However, it appeared probable that azinphos-methyl concentrations in the La Salle River exceeded calculated tentative water quality objectives suitable for the long-term protection of aquatic life.

The scientific information is too limited to determine the significance of the measured concentrations of triallate towards aquatic life.

REPORT 84-6 Beck, A. E. 1984. Rice Lake Water Quality Before and After Reactivation of the San Antonio Gold Mine. Environmental Management Division. Water Standards and Studies. 61 pp.

SUMMARY

A proposal to reactivate the San Antonio mine and mill raised concerns about environmental impact of the operation upon Rice Lake. A pre-reactivation study was conducted in order to develop an extensive background data base from which potential future impacts could be assessed. Water physicochemistry, metal levels in sediments and fish muscle tissue, benthos populations and phytoplankton were examined. A spill of tailings shortly after start up prompted a second study. Efforts in this instance were restricted to assessing impact upon the water column. A third study was conducted approximately five months after start up in order to assess initial impacts upon water physicochemistry.

The pre-reactivation study determined that historic operation of the mine and mill had resulted in significant loading of mercury, copper, iron and manganese to the sediments of Rice Lake.

Iron and manganese appeared to have been physically eroded from the tailings area whereas mercury and copper appeared to have been transported by cyanide complexation. Elevated mercury concentrations in fish muscle tissue were attributed to historic sediment loading. Long term negative impacts upon benthos and phytoplankton were not detectable.

The pre-reactivation study also determined that mine shaft dewatering added 0.93% to the volume of Rice Lake. This process caused a temporary significant elevation in water column levels of conductivity, pH, alkalinity, calcium, lead and copper. Elevated copper and lead concentrations in fish muscle tissue were also attributed to the dewatering process.

The January 27, 1982 spill of tailings to the ice of Rice Lake caused no detectable impact upon the water physicochemistry of Rice Lake. This was because tailings materials were frozen to the lake ice and subsequently dispersed slowly during breakup. Similarly, with the possible exception of water column arsenic concentrations, five months operation of the mine and mill caused no detectable impacts upon water physicochemistry. However, subtle impacts may have been masked by the pre-reactivation discharges of mine shaft water.

REPORT 84-7 Wilson, D. A. 1984. A Background Study of Trout (Embury) and Cliff Lakes. Environmental Management Division. Water Standards and Studies. 67 pp.

SUMMARY

A joint venture development of Trout Lake Mine was proposed for the western shore of Trout Lake. The proposal raised concerns regarding potential degradation of source waters for Flin Flon's water supply. A predevelopment study was planned for Trout Lake and Cliff Lake in order to provide a background against which environmental control measures proposed for the minesite could be assessed. Water column physicochemistry, metal concentrations in sediments and fish muscle tissue, benthic populations and phytoplankton populations were examined.

It was determined that Trout Lake was best classified as ultra-oligotrophic while Cliff Lake was best classified as oligotrophic. Moderate benthic productivity rates and high diversity indices were consistent with these classifications.

Metal concentrations in the water column, sediments and fish muscle tissue provided opportunity for comparisons to several earlier investigations. Consistent with assessments of the earlier studies, it was concluded that copper and zinc were loaded at differing rates to Trout Lake and Cliff Lake due to aerial deposition from the Flin Flon smelter stack emissions. Contrary to some studies, it was concluded that arsenic concentrations in the two lakes were primarily derived from natural geological sources. Also unlike some studies, it was concluded that a definite link between lead, mercury and cadmium concentrations to anthropogenic sources could not be firmly established. Evidence of nickel loading was not found.

ASSESSMENT REPORTS

Beck, A. E., D. J. Brown and D. A. Williamson. 1984. Water Quality Assessement Report: Water Quality in the Vicinity of the Cold Lake Water Treatment Plant Intake. Environmental Management Division. Water Standards and Studies. 7 pp.

Beck, A. E. 1984. Preliminary Assessment: Aquatic Impacts of the Lynn Lake Tailings Area. Environmental Management Division. Water Standards and Studies. 16 pp.

Williamson, D. A. 1984. Water Quality Evaluation: Impacts upon the Whitemud River from the Town of Gladstone's Conventional Sewage Lagoon Wastewater Effluent Discharges. Manitoba Environment and Workplace Safety and Health. Water Standards and Studies. 6 pp.+ Appendices.

SUMMARY

The Clean Environment Commission held a public hearing on August 9, 1984 in order to consider evidence for the purpose of prescribing limits, terms and conditions regarding effluent discharges to the Whitemud River from the Town of Gladstone's conventional sewage lagoon. Downstream users expressed concern that such discharges could impair their use of the Whitemud River. The present water quality assessment investigated the impacts upon the Whitemud River by wastewater effluent discharges from the Town of Gladstone's conventional sewage lagoon.

Examination of historical Whitemud River water quality data indicated that impacts due to previous discharges emanating from the Town of Gladstone's conventional sewage lagoon were not evident. Interpretation of water quality data collected on October 9, 1984, indicated numerous water quality changes attributable to these wastewater effluent discharges. Such water quality changes were small in magnitude and should not impair present downstream uses. The water quality changes observed on October 9, 1984 were predictable using a time-integrated mass balance loading equation.

DATA REPORTS

Hughes, C. E. 1984 Valley River Watershed Study: Preliminary Water Quality Data Report. Manitoba Environment and Workplace Safety and Health. Water Standards and Studies. 15 pp. + Appendices.

Williamson, D. A., D. J. Brown and A. E. Beck. 1984. Water Quality Data Report: Un-ionized Ammonia Concentrations at Selected Sites in Surface Waters of Southern Manitoba. Manitoba Environment and Workplace Safety and Health. Water Standards and Studies. 4pp. + Appendices.

MISCELLANEOUS

1.) Guide to Eating Fish From the Assiniboine River.
This one page summary outlines the recommended maximum weekly consumption of fish from the Assiniboine River with respect to mercury concentrations. Specific information is available for Lake of the Prairies, the Brandon area and the Portage la Prairie area.

2.) Guide to Eating Fish From the Red River.
This one page summary outlines the recommended maximum weekly consumption of fish from the Red River with respect to mercury concentrations. Specific information is available for the Emerson area, the St. Norbert area and the Selkirk area.

3.) Guide to Eating Fish From the Souris River.
This one page summary outlines the recommended maximum weekly consumption of fish from the Souris River with respect to mercury concentrations. Specific information is available for the Souris area.

4.) Guide to Eating Fish From the Winnipeg River.
This one page summary outlines the recommended maximum weekly consumption of fish from the Winnipeg River with respect to mercury concentrations. Specific information is available for Eaglenest Lake, Pointe du Bois and Lac du Bonnet.